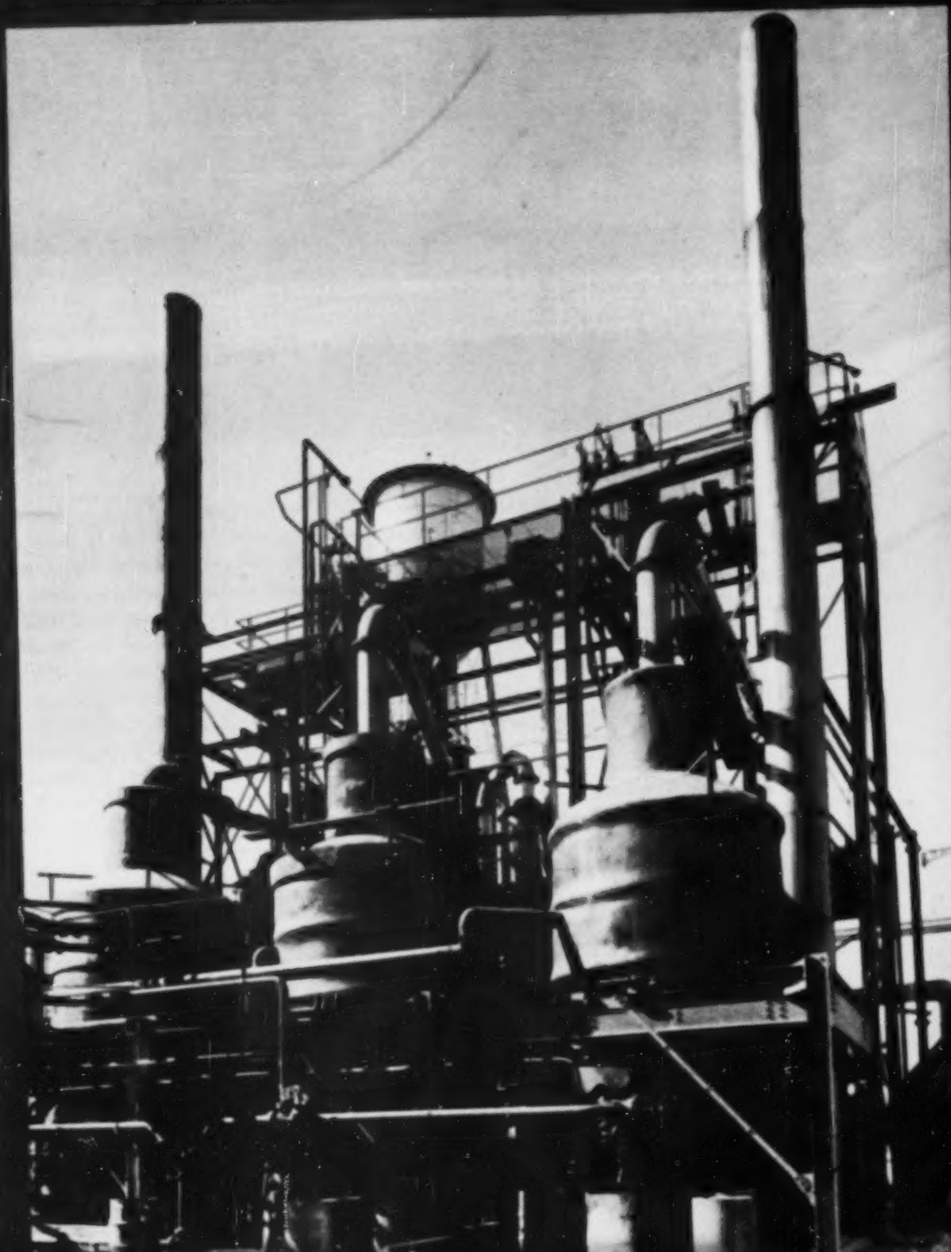
The Spokesman



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The INSTITUTE SPOKESMAN

Published monthly by

The National Lubricating Grease Institute

4638 Mill Creek Parkway, Kansas City 2, Mo.

Harry F. Bennetts, *Editor*

1 Year Subscription $2.00 1 Year Subscription (Foreign) $2.75

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ABOUT THE COVER

This is a view of three stills at one of the W. C. Hardesty Company, Inc., plants. Hardesty has set up complete manufacturing facilities for the processing of fats and fatty acids at strategic locations. Plants at Dover, Ohio; Los Angeles, California; and Toronto, Canada serve industries in the United States, Canada, Mexico and South America.

The quality of the fatty acids and glycerides offered to grease manufacturers by W. C. Hardesty Company, Inc., is checked by tests designed especially for greases. The usual chemical and physical tests are made to determine the type and grade of the fatty acids and glycerides and then these products are used in compounding greases which are subjected to special tests.

The oxidation stability test known as the Norma-Hoffman test, determines the resistance of greases to oxidation when the greases are in contact with oxygen under pressure at elevated temperatures. The sample is placed in shallow dishes in a stainless steel bomb which is filled with oxygen at a pressure of 110 psi and the bomb is held in an oil bath at constant temperature until the pressure of the oxygen drops to a predetermined level due to absorption of oxygen by the grease.

(Continued on page 24)

President's page

by Arthur J. Daniel, President, N.L.G.I.

THE OVERLOOKED MAN

The advent of the Industrial Revolution brought a big change into the lives of those who were concerned with the simple problem of "greasing" the hubs and springs of wheeled vehicles. For as the first crude machines became more complicated in design, there arose a need for new developments in lubrication to keep pace with these mechanical advancements. Modern machines, the basis of our mechanized civilazation, could not operate if it were not for the knowledge and skill of the Lubricating Engineer. And the complex industrial machines of today, with their thousands of moving parts, has made him a key member of our mechanical society. Unfortunately, management does not always realize this fact.

LOST PRODUCTION IS GONE FOREVER

It is not sufficient that machines merely "operate", for competition demands that they be operated at the highest peak of efficiency if profits are to be made. Previously when machines ran at slow speeds, loss in production time could be regained by running extra hours. But now the high production rates of modern machinery make it almost impossible to regain this lost production. Thus the Lubrication Engineer has become an increasingly important part of the business management team.

THE LUBRICATION ENGINEER AND PROFITS

The lubrication specialist has his first important task in assisting in the design of the equipment. But his work does not stop with design . . . he is a vital factor in keeping the equipment at top efficiency and to do this he must control lubrication schedules and see that the proper lubricant is applied to each part of the plants equipment. His knowledge of machine requirements, the characteristics of various lubricants and the quantities required, make him a valuable partner of the firms Purchasing Agent. Reduction in lubricating grease inventories, the lowering of maintenance costs, and the elimination of hazards caused by improper lubrication are all essential duties which the Lubrication Engineer can perform to help management increase their profits.

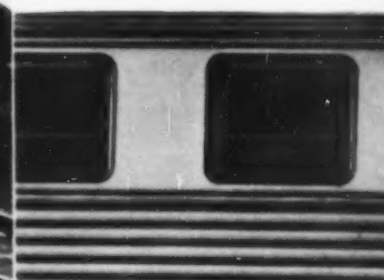
THE LUBRICATION ENGINEER AND SALES

In the past our organization has concerned itself with the advancement of industry standards and the development of technical processes and testing standards. The NLGI's history has been filled with many outstanding examples of success and, within the scope of its operation, it has been a highly profitable venture for its members. But merely creating "better greases" does not increase their use and it is to the Lubricating Engineer that we must look for an answer to this problem. For he knows how and where these greases may be employed to increase the efficiency of the equipment in his plant.

OUR COMMON PROBLEM

It appears then, that we have a common problem in promoting a better understanding of the importance of the Lubricating Engineer on the management team. Management must be educated to the fact that a competent lubrication man can save his firm many times his salary in increased production and in savings on equipment and supplies. When this is done the "better greases" developed through the leadership of the NLGI will be more readily used for the benefit of our entire economy.

Lubrication of roller bearings on New York Central's "New England States" is now being changed to lubricating greases.



Right—View of Roller Bearing Truck now being converted to use lubricating greases.

Use of Grease for Lubrication of Railroad Passenger Roller Bearing Journal Assemblies

By

Walter F. Collins, Engineer, Tests

Kenneth D. Relyea, Dynamometer Engineer, Test Dept.

New York Central System

Practically all modern railway passenger equipment in the past decade has been built with anti-friction journal bearings of the roller type. Several manufacturers are producing an anti-friction roller bearing for this service.

The maximum bearing speeds are in the neighborhood of 800 rpm and are not considered excessive. Sufficient room is available so that each manufacturer can design for desirable bearing loads.

Lubrication itself has presented no major problem. However, the type and severity of service has necessitated careful and frequent attention to insure an adequate oil level at all times. In the case of the New York Central System, this inspection period has been seven (7) days for one type and fifteen (15) days for the others.

Although each manufacturer has a specification for the oil to be used, it has been to the advantage of the railroads to use oils available at car yards and terminals. Car oil with a viscosity of 450 SSU at 100 F. has been used for years in Hyatt assemblies due to the necessity of providing adequate thrust block lubrication. Timken and SKF were until recently lubricated with a viscosity of 175 SSU at 210 F. At present, car oil is now being used for all assemblies. With the use of car oil, even greater care is necessary to prevent excessive leakage from the back of the box. However, in general oil has been satisfactory as a lubricant for roller bearings. One may well inquire, why the interest in grease lubrication?

The reasons for the use of grease are chiefly economic. Like other industries the railroad has been faced with rising costs, while at the same time the price of the transportation is strictly regulated by the government. In order to show any profit at all, efficiency of operation must be continually

improved and a high level maintained. We feel that the use of grease for the lubrication of journal roller bearings is a step in the right direction. Several reasons have lead to this conclusion:—

1. Oil seals are difficult to maintain and loss of oil from boxes require inspection and attention every 15 days. With the number of roller bearing assemblies increasing daily, this necessary attention results in added maintenance costs.

2. Loss of oil from the boxes is conducive to failure of the bearings in road service.

3. Boxes in storage and under cars in storage when oil lubricated, require frequent movement to maintain an oil film on the rollers to prevent corrosion.

4. Regardless of all safeguards the frequency of inspection and handling of oil is conducive to dirt and other foreign material entering the bearing housing.

The use of a proper grease will in our opinion reduce or eliminate all of the above difficulties encountered with oil. It is recognized that the unit cost of grease is roughly three times that of oil and any advantage or economy involved in its use would have to come from the maintenance, which is predominately labor.

Tests with grease lubricated roller bearing assemblies were conducted about 15 years ago but results were unfavorable due both to the consistency used and the lack of suitable oxidation inhibitors.

Interest in grease lubrication on the New York Central System was revived about three years ago with application of a N.L.G.I. zero consistency grease with good oxidation stability to American Steel Foundry type roller bearings then operating in some of our Pullman cars. In this type of bearing the outer race is pressed in the wheel hub and the inner race on the axle. The axle does not normally revolve as in most of the present assemblies. The selected grease performed satisfactorily in continuous service without attention for 60 days. The number of bearings of this design were relatively few and were being retired from service due to obsolescence. A change from oil to grease on these bearings did not appear advisable.

Encouraged by these results, a service test was started with bearing assemblies of present design. The bearings were applied to several of the New York Central new stainless steel streamlined coaches received from the Budd Company. As all roller bearing assemblies are made to fit the same pedestal opening, tests on all designs with various greases could be accomplished on the newest equipment. The coaches so equipped were given break-in runs for observation and then assigned to the New York Central PACEMAKER trains which afforded high speed service with rapid build-up of mileage approximating 28,000 miles per month.

No pre-conceived ideas were formed as to type of grease to be tested but initial discussions with the bearing and grease manufacturers indicated greases between the zero and number two consistency, the preference of most bearing people being the number zero. Although the primary objective was to determine the practicability of lubricating journal roller bearings with grease, development of a New York Central System specification for a grease for this service was also desired, if possible to develop. This grease would have to be suitable to all types of assemblies in service.

Fifteen (15) different greases are or have been under test and others are on hand for consideration and application. In each case the grease manufacturer has been fully informed of purpose for which the grease was to be used and the performance desired. The bearing manufacturers were fully consulted and approved of the test program. Each grease was sampled and analyzed in our laboratory before being put on test.

In all initial and many subsequent applications the representative of the roller bearing manufacturer disassembled and thoroughly examined the bearings before the application of grease. Representatives of the grease manufacturers were also present during application. Initial inspection periods were very frequent but as knowledge increased confidence was established and inspection periods extended to three months intervals which is now an accepted period.

The greatest number of experiments have been made with radial type bearing assemblies due to the necessity of properly lubricating the solid thrust block. Lack of sufficient lubrication is generally indicated by a scoring of this block. A grease to adequately lubricate this thrust block must be fluid enough to work to that point or bleed enough to provide a film of oil. The spherical and tapered type of bearing takes the thrust directly on the bearing and the lubrication problem is only concerned with the actual bearing assembly.

All manufacturers of railroad journal roller bearings are now developing assemblies designed exclusively for grease or combination boxes to use either grease or oil. Laboratory and field tests are now being conducted with grease designed boxes but to date too little service is available to draw any long range conclusions.

Bearing in mind that the greater majority of tests were conducted on boxes originally designed for oil, we have collected sufficient data on these assemblies to draw the following conclusions on the use of grease as a journal roller bearing lubricant:—

1. All roller bearing assemblies under test operated satis-

Here is the type of Stainless Steel Car soon to be lubricated with lubricating greases.

factorily when lubricated with a first quality N.L.G.I. Zero grease containing a good oxidation inhibitor.

2. Soda base greases have given the best results to date.

3. It was found that performance varied widely between the same consistencies of different manufacturer's grease.

4. Some manufacturers assemblies will require periodic lubrication attention due to leakage through the back of the box. Other types will operate between wheel turning periods (150,000 to 200,000 miles) without intermediate attention.

5. Some greases will perform well for upwards to 200,000 miles and then turn to a heavy tar-like substance. This rather sudden breakdown of the grease indicates to us an insufficient amount of oxidation inhibitor.

6. One brand of a number two consistency has exceeded 575,000 miles in service on spherical type bearings without any intermediate attention. The grease will be removed and subject to laboratory examination as soon as the wheels are removed from service.

7. Generally greases heavier than 340 penetration do not tend to circulate beyond the actual bearing path, while most zero greases show circulation throughout the entire box.

8. Certain manufacturer's bearings are made with bronze parts. It has been noted greases that failed in service, failed earlier in assemblies where bronze was used indicating oxidation inhibitors must prevent acceleration due to presence of this metal which may act as a catalyst.

9. High temperatures are not a factor in this type of lubrication as the bearings operate under 200°F.

10. A specification for a grease for journal roller bearing assemblies is now under study but for the present the New York Central System is using brand name greases in the number zero consistency range which has been approved after a satisfactory service test.

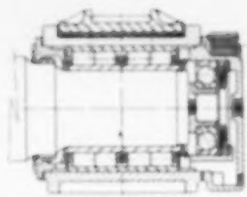
11. Inspection periods have been established at 90 day intervals at which time a pound of make-up grease is added to compensate for leakage.

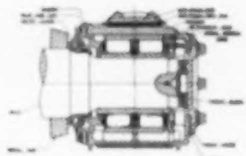
12. An important point from the railroad standpoint is compatability. Few railroads restrict their purchases to one manufacturer and this aspect must be considered in service requirements.

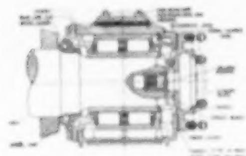
13. Another feature noted is the maintenance of a reasonable consistency after use. In radial type bearings a milling action takes place and will increase the consistency while in tapered bearings the consistency will not greatly change from the original.

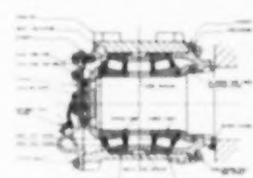
ERRATA NOTICE

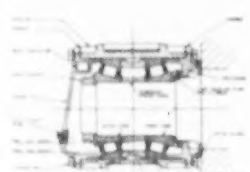
On Page 17 of the March, 1950 issue, Figure 6 incorrectly read "Recovery in Consistency equals Reciprocal of Microcone Penetration after Shell Ross Test of Two Typical Greases." It should be "Recovery in Consistency (= Reciprocal of Microcone Penetration) after Shell Roll Test of Two Typical Greases."

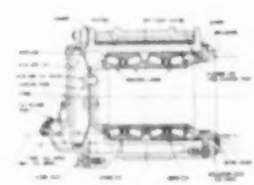












SKF—Roller Bearing

SKF—Roller Bearing

Bentone Greases

By

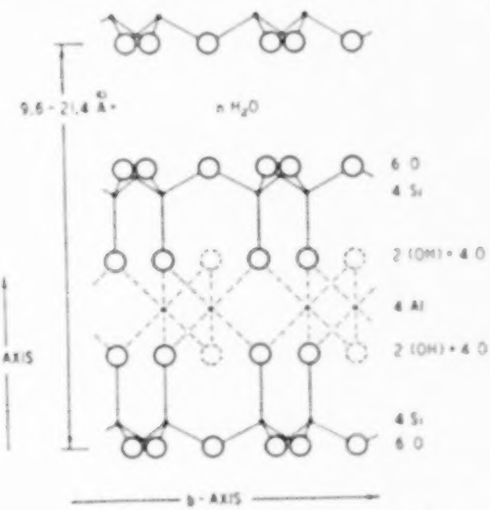
C. Malcolm Finlayson,
National Lead Company

and

P. R. McCarthy,
Gulf Research & Development Company

In any discussion of lubricating greases prepared from BENTONES, it seems desirable to first give a brief description of the BENTONES and explain their thickening action. This has been done in detail by J. W. Jordan in a paper entitled "Organophilic Bentonites. I. Swelling in Organic Liquids", which appeared in the JOURNAL OF PHYSICAL AND COLLOID CHEMISTRY, Vol. 53, No. 2, 1949, pages 294-306.

BENTONES are the reaction products of bentonite, or, more accurately, montmorillonite, and various organic cations. Montmorillonite is a hydrous magnesium aluminum silicate, with a micaceous structure and an exceptionally small ultimate particle size. It occurs customarily as the salt of the moderately strong acid. The montmorillonite used for the production of the BENTONES is the Wyoming type in which the cation is perdominantly sodium.



MONTMORILLONITE $(OH)_4Al_4Si_8O_{20} \cdot nH_2O$

FIGURE 1

The schematic representation of montmorillonite (Fig. 1) consists of one gibbsite sheet between two sheets of silica tetrahedral groups. Isomorphic replacement of Mg^{++} for Al^{+++} provides the charge necessary to hold cations. It will be noted that the thickness of a particle is 9.6 Angstrom units or approximately one millimicron. In the other two dimensions the size is of the order of 20 millimicrons, so that the particle is a sheet or platelet of very small size with a very large number of inorganic cations on each surface. In addition, some cations are held by the broken bonds at the edges of the platelets.

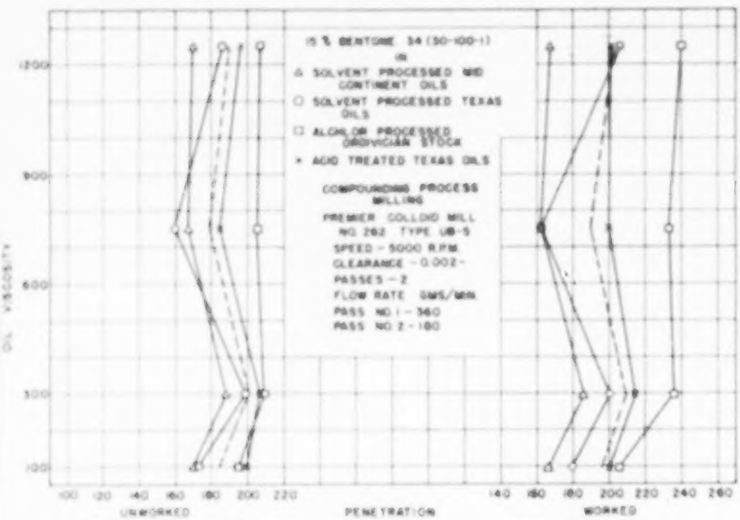
When montmorillonite is dispersed in water, the platelets separate to their ultimate particles and each platelet orients water molecules about it in hexagonal configuration. This action gives rise to the thixotropic gels of montmorillonite in water which make it valuable in oil well drilling muds and other applications.

To prepare a BENTONE, the montmorillonite is hydrated in a very dilute dispersion to separate the unit particles, and is purified by super centrifugation to achieve complete removal of non-clay impurities. This step is resorted to since most montmorillonites in the crude state contain relatively large quantities of quartz which, if allowed to remain, would impart an abrasive character to the resulting product. The reactive sodium atoms of the unit plates are then replaced by organic cations and the product washed, filtered, dried, etc., to give the final BENTONE. A suitable cation is ammonium.

By proper choice of the organic cation the properties of the resulting BENTONE can be controlled. Use of a short

chain alkyl ammonium salt gives a BENTONE with slight organophilic properties and retention of a large part of the original hydrophilic properties. Increasing the chain length of the alkyl ammonium salt gives increasing organophilic properties. Use of a quaternary ammonium salt with two long chains, say 16 to 18 carbon atoms each, gives a completely hydrophobic and organophilic BENTONE, and greatly improves the heat stability.

These products then have no affinity for water, but because of the hydrocarbon chains coating the platelets, they



EFFECTS OF OIL ORIGIN—REFINING METHOD AND VISCOSITY ON YIELD
GRAPH NO.1

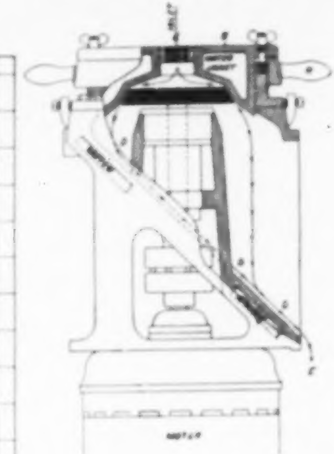
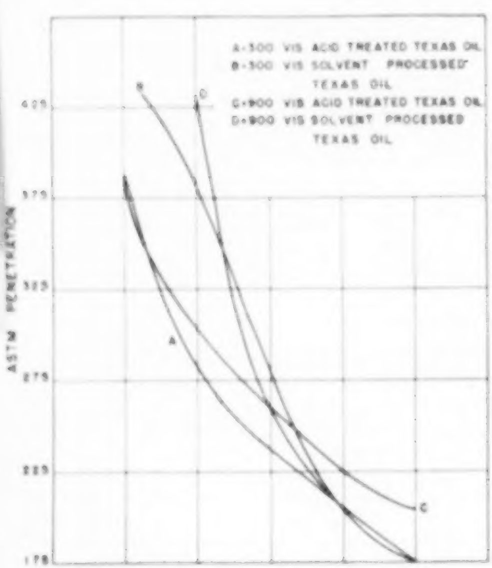
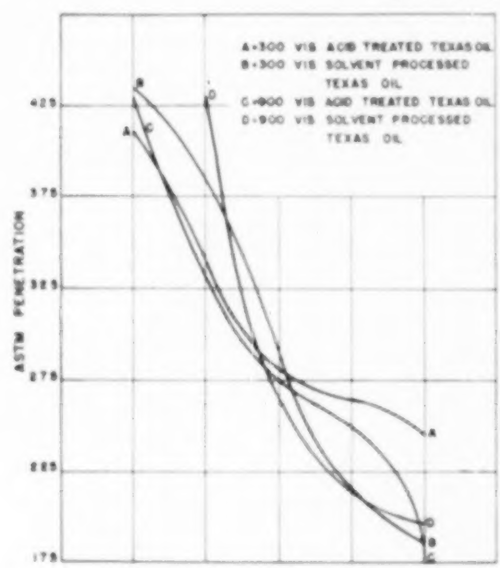


FIGURE 2

A—Rotor
B—Stator
C—Material Inlet
D—Spillway
E—Material Outlet
R—Micrometer Adjusting Ring



UNWORKED PENETRATION VERSUS BENTONE CONTENT
GRAPH NO.2



WORKED PENETRATION VERSUS BENTONE CONTENT
GRAPH NO.3

disperse readily in organic liquids to their ultimate platelets, and bind the organic liquids in oriented layers. This mechanism results in gel systems in which the organic liquid phase is held immobile as a hull around a hydrocarbon-coated montmorillonite platelet which is approximately two millimicrons thick and about 20 millimicrons in the other two dimensions.

The gel is physical in nature and does not depend on maintenance of a matrix to hold oil. As a result there is no possibility of a change in phase from solid to liquid, and also, the characteristics of the grease are those of the oil since the gelling particles have essentially lost their identity due to their very small size, their hydrocarbon coating, and the fact that each particle is completely surrounded by layer on layer of oil.

BENTONE 34, which is the BENTONE used in the preparation of the greases to be discussed, is one of many possible BENTONES. To be effective in gelling an organic liquid such as a lubricating oil, it is only necessary to get the BENTONE dispersed to the ultimate particle. In liquids of high activity and mobility, for instance toluene, this dispersion is accomplished by simple stirring. As the mobility and activity of the liquid decreases, energy, either as heat or work or both, is necessary to effect complete dispersion. Thus, in a high viscosity, highly paraffinic lubricating oil, milling, such as three-roll paint milling or passage through a colloid mill, is required to achieve satisfactory dispersion. The resulting gelled oil is the complete grease, having been achieved by physical rather than chemical means.

Greases have become widely known as the products obtained when oils are thickened by the metallic soaps of fatty acids. The lubricants discussed in this paper cannot truly be called greases in that the oils are not thickened by a soap, but instead are gelled by a compound obtained by bringing together a bentonite and an organic base. For ease of presentation, however, these compositions wil lbe referred to as Bentone greases.

The preparation of the Bentone greases is theoretically a relatively simple operation accomplished by premixing a slurry of the petroleum oil and Bentone followed by a milling operation. The foregoing premise is based on experience to date on batches prepared in the laboratory. It is probable that a change from the production of a relatively few pounds per day to possibly tons per day would considerably alter the picture. Superficially, it would appear that if the proper type of equipment were used, the potential production capacity for Bentone greases would be at least on a par and possibly much greater than for most conventional greases.

The machine used for the preparation of Bentone greases by this laboratory was a 3" Premier Colloid mill, a picture and description of which were kindly furnished by the manufacturers.

PICTURE AND DESCRIPTION

Figure 2 illustrates the working parts of the Premier Colloid mill. Rotor A consisting of a smooth face upon a frustum of a cone, is driven either directly or by a pulley system through a shaft suspended in ball bearings mounted in the center of the main casting. The Rotor is surrounded by the Stator B. The desired clearance between the faces of the rotor and stator is obtainable by means of the micrometer adjusting Ring R. The material enters through Inlet C, passes through the annular clearance between A and B, and emerges through Outlet E.

The Premier Colloid mill works on the principal of a hydraulic shearing action produced in a very thick film of liquid. Everything that is processed in a Premier Colloid mill must have some liquid present. As the material is drawn or forced into and spread out in the narrow space between the rotor and stator it becomes subjected to tremendous shearing forces set up by the high speed of the rotor on one side and the stationary stator on the other. Solid particles present in this liquid film are dispersed into particles of microscopic dimensions.

It was found that a fairly constant flow rate was necessary to prevent a deposit of Bentone building up between the rotor and stator. This was accomplished by attaching an Alemite air operated grease pump to the inlet of the mill. The operating air pressure for the pump was controlled with a Lunkenhiemer valve capable of fine adjustment. The desired flow rates were obtained by proper adjustment of the air control valve.

A peripheral rotor speed of approximately 10,000 fpm was too fast and resulted in temperature sufficiently high to char the products with which we were working. It is believed that the charred appearance may be caused by decomposition of the organic portion of the Bentone. The speed was reduced to 5000 fpm and this problem was eliminated although high temperature will still develop if the rate of throughput is too low.

Maximum grease yield for a given Bentone content usually can be obtained by a two pass process at a stator-rotor clearance of approx. 0.002" and flow rates of 360 gms./min. and 180 gms./min. for the first and second passes respectively. The foregoing is based on data obtained with a 3" mill and would not necessarily hold true for larger size equipment.

PROPERTIES OF BENTONE GREASES

1. *Yield*

The effect of various oil types, refining methods and viscosity on grease yield can best be illustrated by the following graphs: Nos. 1, 2, and 3.

In general products of equivalent consistency can be obtained with somewhat less Bentone than with equivalent amounts of conventional soaps. However, as was illustrated by the foregoing, the thickening action of low concentrations of Bentone is probably less than for equivalent amounts of soaps.

TEMPERATURE CHARACTERISTICS, WORKING STABILITY, AND CONSISTENCY

Chart No. 1 and Graph No. 6.

The working stability and consistency-temperature characteristics of the Bentone greases are usually superior to the conventional greases. These properties in part might result from the fact that (a) the milling operation used for the production of the Bentone greases tends to stabilize them against further breakdown and (b) the lack of temperature effects on Bentone itself are imparted to the Bentone greases.

Chart No. 1 lists the composition of, and comparative data on a series of experimental Bentone and conventional base greases. It will be noted that in the majority of cases the Bentone greases are more resistant to consistency breakdown than are the corresponding soap base greases.

Graph No. 6 illustrates the comparative effects of temperature on the consistency of a series of Bentone and conventional base greases. It will be noted that the various phase and structure changes apparent in the soap base greases are entirely lacking in the Bentone grease.

dency appears to be very slight regardless of the type of oil.

Graph No. 8 shows that the Bentone greases are similar to conventional greases insofar that increased bleeding will occur in the softer products. However, the tendency to bleed is considerably less for the Bentone greases than it is for conventional greases of equivalent soap content.

CORROSION

The corrosive effects on brass and copper as determined by the AN-G-25 method appear to be negligible. Any corrosive effects which might occur will be due primarily to

CHART NO. 1
WORKING STABILITY
PRECISION AUTOMATIC WORKER

	GREASE TYPES									
	CHASSIS		WHEEL BEARING		ANTI-FRICTION				ANG-15 TYPE	
COMP., % BY WEIGHT	A	B	A	B	A	B	C	D	A	B
Oil, %	94	90	86	85	82	85	85	86	87	88.5
Soap, % and Type	6 (NaCa)		14 (Na)		18 (Na)		15 (Na)		13 (Li)	
Bentone		10		15		15		14		11.5
Oil, Vis. Sus @ 100°F.	1140	1140	1020	1020	255	255	2400	2400	125	125
CONSISTENCY										
Normal Worked Pen.	363	373	287	291	230	247	270	240	274	263
Pen. 100,000 Strokes	369	373	355	313	359	290	339	263	361	321
% Pen. Increase	1.6	0.0	23.7	7.5	56.1	17.4	25.5	19.6	31.8	22.0

DROPPING POINT

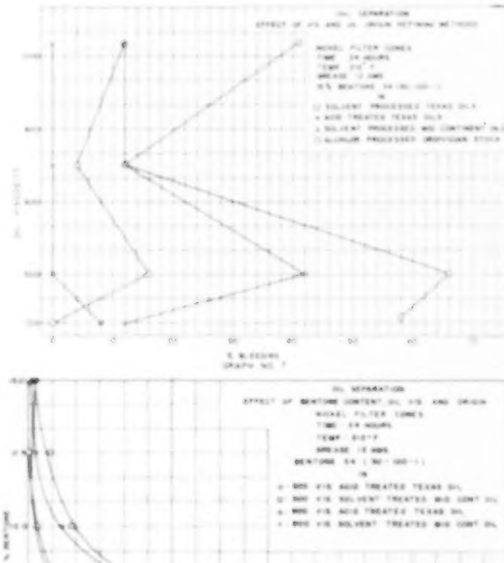
The dropping point of these greases is well over the flash point of oils used in grease production.

BLEEDING

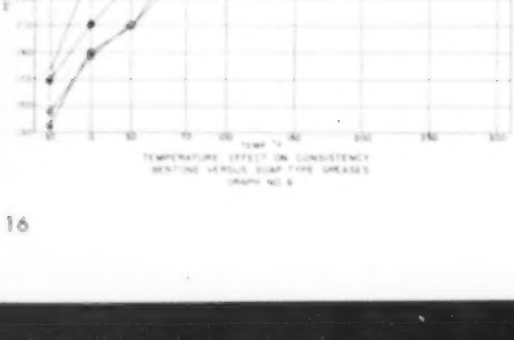
The effects of oil origin, refining methods, oil viscosity, and Bentone concentration on bleeding are illustrated by Graphs Nos. 7 and 8.

This characteristic was determined by weighing a specific amount of grease into perforated nickel filter cones, suspending the cones in tared beakers, storing the assembly at 212°F. for 24 hours and then weighing the beakers. The increase in weight of the beakers was calculated as percent bleeding.

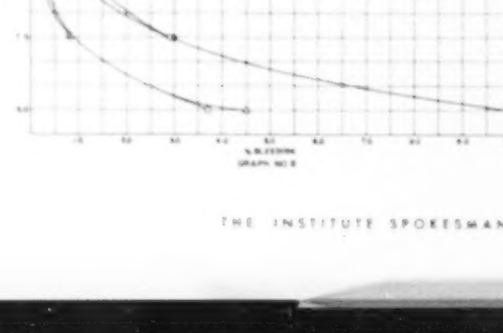
Graph No. 7 indicates that increased bleeding will occur with more highly refined oils. However, the bleeding ten-



% BLEEDING
GRAPH NO. 7



TEMPERATURE EFFECT ON CONSISTENCY
BENTONE VERSUS SOAP TYPE GREASES
GRAPH NO. 6



% BLEEDING
GRAPH NO. 8

the characteristics of the base oils or to any additives which might be used.

OXIDATION RESISTANCE

Uninhibited Bentone greases seem to be very similar to uninhibited soap base greases with respect to their reaction in the A.S.T.M. bomb test. Induction periods are relatively short and correspond to those of conventional greases if the base oils of both are equivalent in nature and viscosity. However, as with the soap base greases, the Bentone greases can be inhibited to give long induction periods by the selection and use of the proper oxidation inhibitors.

Graph No. 9 illustrates the improvements in oxidation resistance effected by the addition of 0.4% of a particular oxidation inhibitor to three Bentone greases.

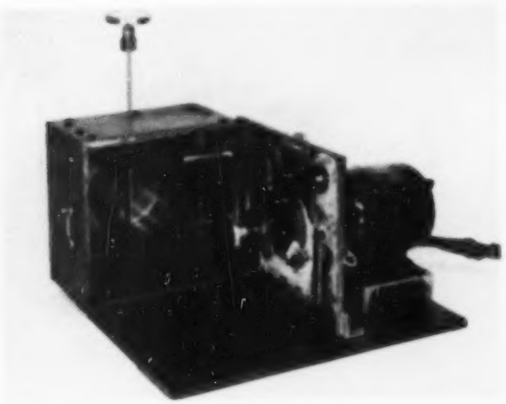
METAL ADHESION

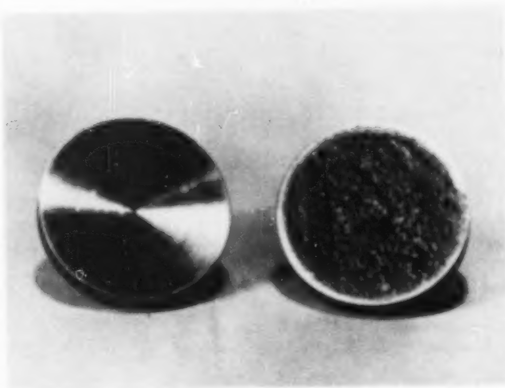
A grease may have many exceptional properties but if it fails to adhere to moving metallic or other surfaces, it is useless. The adhesion of the Bentone greases to moving metallic surfaces appears to be one of their best properties.

The apparatus (Figures No. 3 and 3A) used for determination of metal adhesion consists of an 1800 rpm motor, the shaft of which extends into an insulated box heated by

CHART NO. 2
METAL ADHESION AND WATER RESISTANCE TEST SAMPLES
COMPOSITION-CONSISTENCY DATA

	GREASE TYPES									
COMP., % BY WEIGHT	A	AB	B	BB	C	CB	D	DB	E	F
Oil, %	94	90	86	85	82	85	85	86	94.0	80.0
Soap, % and Type	6 (NaCa)		14 (Na)		18 (Na)		15 (Na)		6.0 (Li)	16.5 (Ba)
Bentone		10		15		15		14		
Oil, Vis. Sus @ 100°F.	1140	1140	1020	1020	255	255	2400	2400	1143	604
CONSISTENCY										
Unworked	360	352	238	256	193	232	230	213	277	267





Top Fig. 3 ... Below Fig. 3-A.

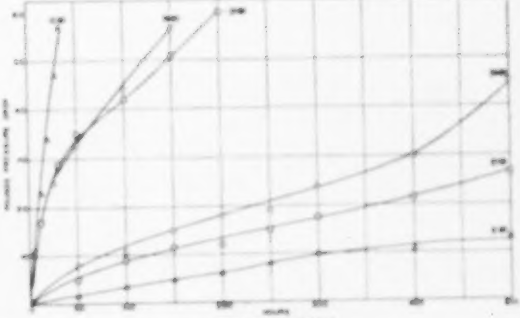
means of a 500 Watt ring heater and thermostatically controlled by a Fenwall Thermoregulator over a temperature range from room temperature to 300°F. The concave discs illustrated is 1½" dia. with the center depressed ⅛". The test method consists of applying approx. 0.50 of a gram of grease to the concave surface, attaching the disc to the motor shaft, regulating the temperature within the desired range, rotating the disc at 1800 rpm for a period of 7 min. The disc is then reweighed and the percent grease retention calcuated.

Chart No. 2 lists the composition, oil viscosity, and consistency of a number of samples.

Graph No. 10 illustrates the comparative adhesive properties of the Bentone and conventional soap type greases listed in the preceding Chart.

The test results by the foregoing method appear to correlate very closely with shackle machine retention tests run in a more complex test apparatus and over a much longer period.

It should be noted that the adhesive properties of the

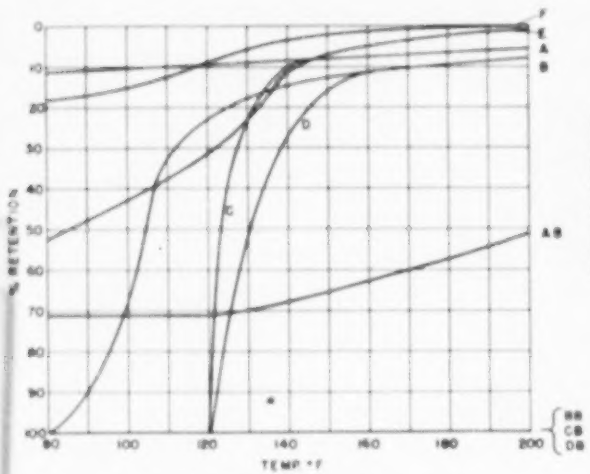


OXIDATION RESISTANCE
UNINHIBITED VERSUS INHIBITED
GRAPH NO. 9

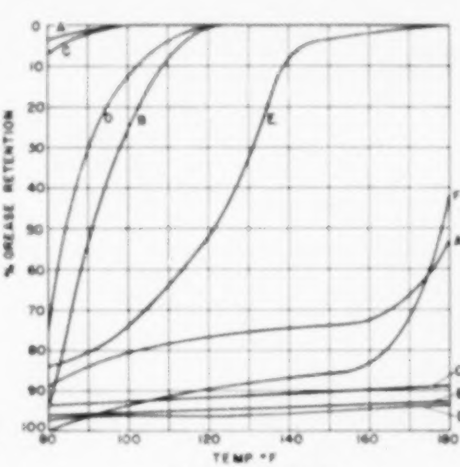
illustrated greases do not appear to be a direct function of consistency or oil viscosity, since greases A, B, C, and D correspond to AB, BB, CB, and DB in the foregoing characteristics.

The better retention characteristics exhibited by the Bentone greases may be due to their lack of fiber structure, since extensive testing has shown that in general the more fibrous the product the less adhesive the grease tends to be.

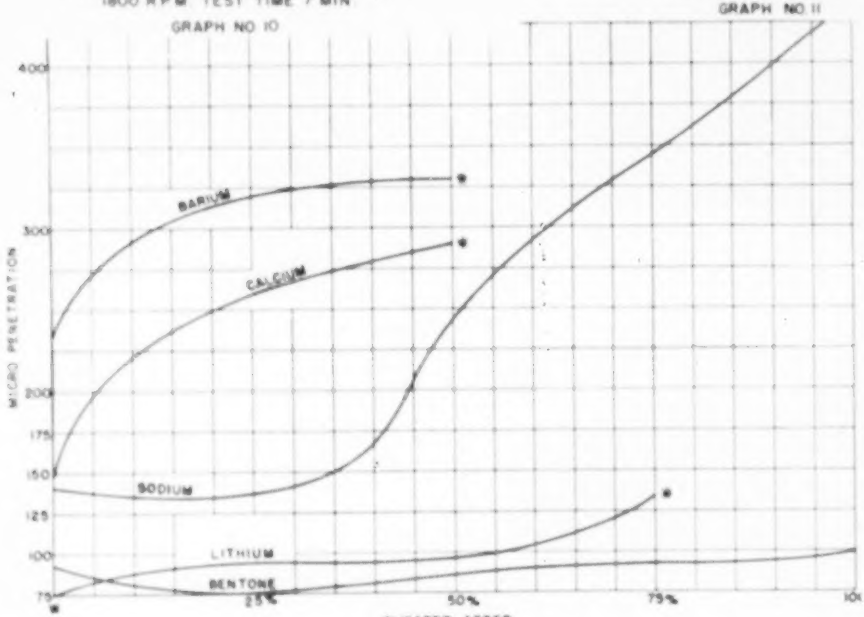
The retention of grease on rotating metallic surfaces may be dependent not only on adhesive properties but also upon the innate cohesiveness and fiber structure of the various grease types.



METAL ADHESION
CONCAVE DISC (CENTER DEPRESSED $\frac{3}{32}$")
1800 R.P.M. TEST TIME 7 MIN.
GRAPH NO. 10



WATER RESISTANCE
ROTATING RACK
500 CC./MIN. TEST TIME 15 MIN.
GRAPH NO. 11



* MAXIMUM ABSORPTION

WATER ABSORPTION
GRAPH NO. 12

Figure 4

Figure 4A

CHART NO. 3
COMPARATIVE SEIZURE AND WEAR DATA
FALEX WEAR TEST MACHINE

FALEX SEIZURE LOAD, POUNDS	GREASES							
	A	AB	B	BB	C	CB	D	DB
(Steel versus steel initial break in period 300 lb. jaw load for 3 minutes, 500 lb. jaw load for 1 min. 250 lb. jaw load increase minute until seizure occurs)	1250	750	1000	1000	1250	1000	1000	1000
FALEX WEAR, TEETH								
(Steel versus steel 30 min. break-in period at 50 lb. jaw load 3 hour test period at 100 lb. jaw load)	7	12	33	26	26	19	16	9
Weight loss of pin, grams	0.0034	0.0051	0.0224	0.0224	0.0281	0.0182	0.0125	0.0115
Weight loss of Block, grams	0.0010	0.0021	0.0022	0.0016	0.0011	0.0007	0.0028	0.0009

WEAR CHARACTERISTICS

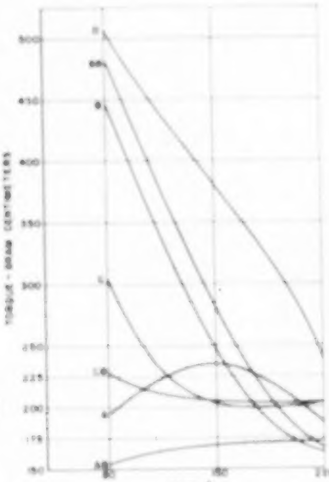
For years, bearing manufacturers have been attempting to seal bearings against the entrance of abrasive materials such as ordinary sand, dirt, or other materials of a siliceous nature.

At first glance the idea of incorporating materials of a similar nature in a grease appears heretical. However, as outlined in the first portion of this paper, the manufacturing process has practically eliminated or at least greatly reduced the abrasive constituents of this material.

Limited comparative data illustrated by Chart 3, show that the seizure loads are practically identical with the exception of greases A and AB and that the teeth wear is somewhat lower for the Bentone greases. The weight loss of the pin and blocks also indicates that the abrasive tendencies of the Bentone greases are probably no greater than those for the conventional soap type greases containing oils of approximately the same viscosity and having approximately the same consistency.

WATER RESISTANCE

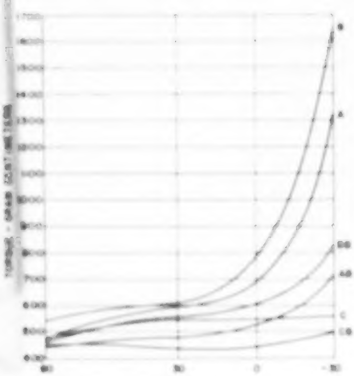
Water resistance of greases may mean one or more things to various people. It may denote resistance to the washing action of water, water absorption or rust prevention. An attempt was made to evaluate the foregoing characteristics



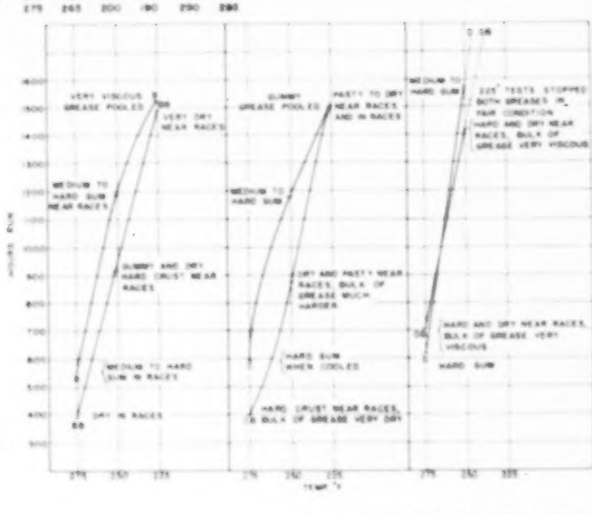
BEC DATA
204 BEARING - GREASE CHARGE 3.0 GRAMS
GRAPH NO. 13

SAMPLE COMP. % BY WT.	A	AB	B	BB	C	CB	D
PETROLEUM OIL	71.0	84.0	77.0	87.5	91.0	88.5	80.0
NA. SOAP	29.0	—	23.0	—	—	—	—
AL. SOAP	—	—	—	—	9.0	—	—
LI. SOAP	—	—	—	—	—	—	20.0
BENTONE	—	16.0	—	12.5	—	11.5	—
OIL VISCOSITY S.U.S. AT 100°F	500	500	500	500	55	55	295
ASTM WORKED PENET.	200	190	275	265	290	280	285
% TOTAL LEAKAGE	3.5	1.3	12.3	0.0	58.0	20.0	8.3

SAMPLE COMP. % BY WT.	A	AB	B	BB	C	CB
OIL	77	87.5	71	84	91	88.5
NA. SOAP	23	—	29	—	—	—
BENTONE	—	12.5	—	16	—	11.5
AL. SOAP	—	—	—	—	9	—
OIL VIS. S.U.S. AT 100°F	500	500	500	500	55	55
WORKED PEN.	275	265	200	190	290	280



LOW TEMPERATURE TORQUE
GRAPH NO. 15



PERFORMANCE DATA
WHEEL BEARING TEST MACHINES
SAF 210 BEARING - GREASE CHARGE 10 GRAMS
750 R.P.M. - LOAD 1000 LBS.
GRAPH NO. 14

of the Bentone greases by the following methods:

1. *Resistance to the Washing Action of Water*

Figures No. 4 and 4A illustrate the machine used for this determination. This apparatus consists of a receptacle in which water can be heated to the desired test temperature and a pump for the circulation of water over the test panels at a rate of 500 cc/min. through a Gulf 50-B coal spray nozzle which produces a wide fine spray. A rack, holding four test panels inclined at an angle of 45°, is rotated at 24 rpm for 15 minutes under the spray.

Panels consist of 1" x 3" x 1/8" Al strips having flat bottom holes 3/8" in dia. x 1/16" deep. Holes in the tared panels are filled level to the surface of the panel, and panels plus grease are weighed. Test is run for 15 minutes at the desired test temperature, panels are reweighed and grease retention calculated.

Graph No. 11 illustrates comparative data on conventional soap type and Bentone greases. The composition, consistency, and oil viscosity were shown on Chart No. 2.

Graph No. 11 will show that the Bentone Greases AB, BB, CB, and DB are fare superior to Na base greases A, B, C, and D of equivalent consistency and oil viscosity. Bentone greases BB and CB are also superior to Li and Ba base greases E and F in this respect.

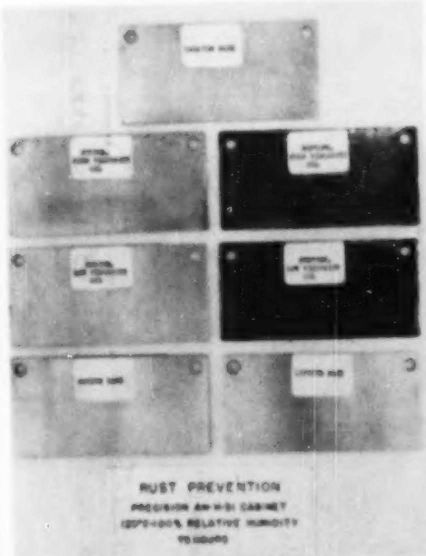
WATER ABSORPTION

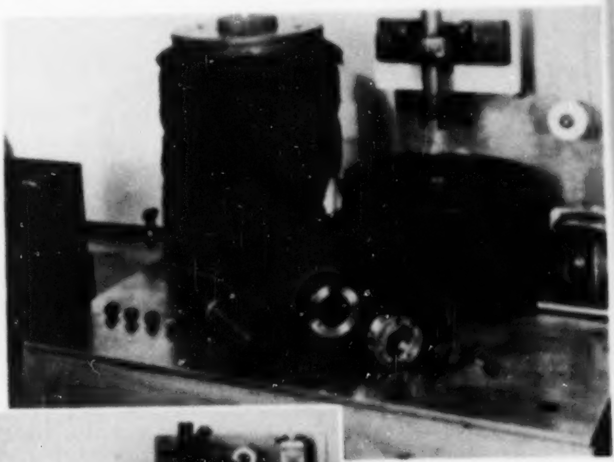
Water absorption was determined as follows:

20 grams of greases were placed in a small grease worker similar in design to the A.S.T.M. worker. Water was added in 25% increments until further absorption would not occur or until the penetration increased over the measurable range. Between the water additions, the water/grease was worked for 120 strokes and consistency determined with the micro penetration assembly. Graph No. 12 illustrates the comparative water absorption characteristics of a series of greases and the effect of water on consistency. It will be noted that although the Bentone greases will absorb considerable water, the effects on consistency, at least up to 125% absorption, are very slight.

RUST PREVENTION

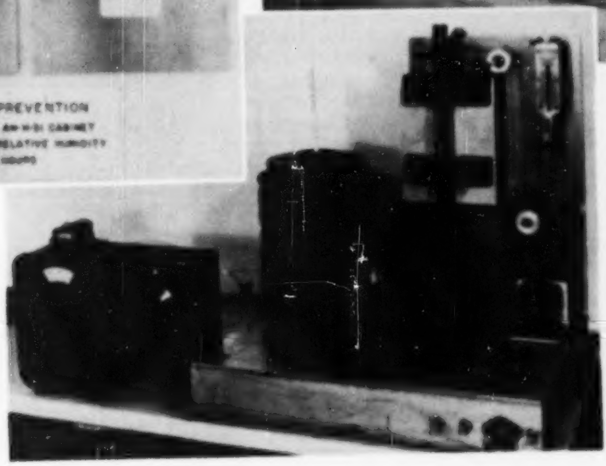
Most of the foregoing data have been complimentary to the Bentone greases, but the next slide will illustrate one of their weak characteristics, namely the lack of adequate rust preventive properties. The next slide (Figure No. 5) shows the comparative effects of 75 hours exposure in an AN-H-31 Cabinet at 120°F. and 100% relative humidity on a series of Bentone and conventional soap base greases. As will be





Top Left—Fig. 5

Top Right—Fig. 6



Right—Fig. 7

noted, no favorable comparison for the Bentone greases exist. However, the selection and use of the proper type of inhibitor can considerably improve this characteristic of the Bentone greases. Greases properly inhibited were in excellent condition after 750 hours under the same test conditions.

PERFORMANCE TESTS—*ABEC Tests*

Although the ABEC machine has become outmoded as a performance test machine, it is still believed that valuable data, namely running torque and leakage characteristics, can be determined through its use.

Graph No. 13 lists the make-up, worked penetration, total greasse leakage, and average running torque at 80°, 150°, and 220°F. for a series of Bentone and conventional base greases.

Although there is variation in running torque, the Bentone greases seem to fall in the same general range as the conventional greases if the oil viscosity and consistency are comparable.

WHEEL BEARING TESTS (Ordnance Specification AXS-1574 Tester and Method)

This test is also useful as a screening test and as such when run by the prescribed method does not and cannot predict the service life of greases. However, it can differentiate to some extent between good and poor products.

Chart No. 4 shows the results of tests on four different batches of an experimental wheel bearing grease. As will be noted, the test results appear excellent and also indicate that the reproducibility of the product is good.

GULF WHEEL BEARING TESTS

A description of the Gulf wheel bearing machines and their operation was covered by Mr. Pigott's paper (SOME TEST EQUIPMENT FOR GREASES) presented to this group in 1947.

The foregoing details will therefore be omitted. The test conditions and results of test on three experimental Na base and three Bentone greases are illustrated by Graph No. 14.

As will be noted the Bentone greases exhibited somewhat shorter service life than did the conventional greases. In all cases cause of failure appeared to be due to the tendency of the Bentone greases to dry up near the races and race path although the bulk of the grease appeared to be in fairly good condition.

Possibly several previously mentioned characteristics, such

CHART NO. 4

AXS-1574 WHEEL BEARING TEST DATA

TEST MACHINE — PRECISION SCIENTIFIC — WEIGHT OF SAMPLE — 90 GRAMS

LENGTH OF TEST — 6 HOURS — SPINDLE TEMPERATURE — 220°F. — SPEED — 450 RPM

SAMPLE — EXPTL. BENTONE WHEEL BEARING — CHASSIS LUBE

			BATCH NO. 1	2	3	4
FLOW OF GREASE FROM/ON	(a)	Hub	NONE	NONE	NONE	NONE
	(b)	Spindle	NONE	NONE	NONE	NONE
LEAKAGE	(a)	Wt. Grams, %	0.0	0.0	0.1	0.0
	(b)	Grease or Oil	NEITHER	NEITHER	BOTH	NEITHER
GREASE CONDITION	(a)	Structure Change	— — —	NONE APPARENT		— — —
	(b)	Consistency				
		Increase, %		12.5		4.3
		Decrease, %	5.3		3.0	
LUBRICATION	(a)	Deposits on Bearings	— — —	NONE		— — —
	(b)	Film of Lubricant or Dry	— — —	FILM		— — —

CHART NO. 5

FUNCTIONAL DEVELOPMENTS IN BENTONE AND CONVENTIONAL Na BASE GREASES DURING PERFORMANCE TESTS

BENTONE GREASES	SODIUM GREASES
COLOR CHANGE	
Darkens rapidly near races much less so away from races	Darkens less rapidly and uniformly
OIL SEPARATION	
Very slight if any oil separation	Moderate to high oil separation
CHANGES IN GREASE DISTRIBUTION	
Channeled throughout entire test	Initial channeling followed by churning as grease softens due to heat of working, returns to channeled state as grease gums.
CONSISTENCY AND STRUCTURE CHANGES	
Grease becomes dry and pasty rather than gummy. Dry condition particularly noticeable near races which become definitely dry. Bulk of grease away from races usually in fair condition.	Grease gradually softens, later becomes viscous and sticky developing into a tough gummy material and finally into a hard gum. Condition applies to bulk of grease as well as small portion in and near races.
TORQUE	
Low to moderate until incrustation occurs, torque is then very high.	Low to moderate during stage previous to pooling. Running torque somewhat higher at test temperature and considerably higher at room temperature. Both running and starting torque decreases during initial gumming stage where channeling may again occur. Torque then increases as formation of harder gum occurs. Gum deposits gradually build up on races and cages until failure occurs.

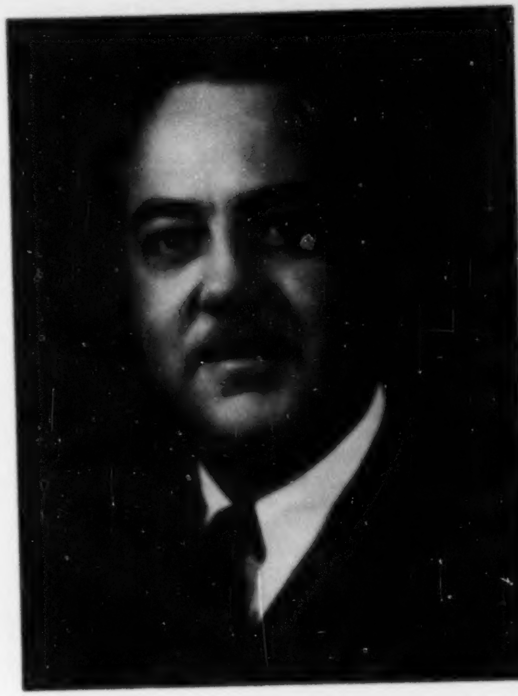
Rheem Manufacturing Company Joins N.L.G.I.

G. Wesley Gates, manager of sales of Rheem Manufacturing Company's Eastern Container Division, has been appointed to membership in the National Lubricating Grease Institute. He has named George B. Fleming, sales manager of the Rheem Container Division's southeastern district at New Orleans, as the company's technical representative to the Institute.

Rheem, world's largest manufacturer of steel shipping containers for years, has supplied grease containers in the familiar 100-pound size and a variety of other standard and special sizes.

Wes Gates joined Rheem Manufacturing Company at Providence, R. I., in 1942, as an expediter. The following year he was made a Washington representative for the firm, charged with contacting the U. S. Navy on Rheem war contracts. In 1945 he came to New York as assistant manager of eastern division container sales, and in mid-1946 he was named to his present post. Prior to joining Rheem, Mr. Gates was associated for nine years with the Hershey Chocolate Corporation. He resides with Mrs. Gates at Bronxville, New York.

George Fleming, Rheem's new technical representative to the Institute, joined the company in 1942 as a salesman at Houston. In 1943 he was transferred to New Orleans, and late that year was appointed southeastern district sales manager. He was previously employed by Standard Oil Company of California and the Hydril Company.



G. Wesley Gates, Rheem's N.L.G.I. Representative

BENTONE GREASES *(continued)*

as resistance to mechanical breakdown and bleeding, considered as necessary by some specification standards may actually be detrimental from a performance angle for some uses.

Comparison of the various changes which were noted during performance tests at elevated temperatures on Bentone greases and conventional Na base greases may be summarized as shown by Chart No. 5.

LOW TEMPERATURE PROPERTIES

Running Torque

Comparative low temperature properties of three Bentone greases and three conventional greases were determined with the apparatus shown by Figures 6 and 7. The test bearing assembly consists of a No. 204 bearing, equipped with removable top and bottom shields, a bakelite shaft to which the inner ring of the bearing is locked, and a bakelite follower to lock the outer ring in the bearing housing. The bearing is cooled by circulation of a coolant through the bearing housing. Temperature is measured by means of a thermocouple inserted through the center of the top bearing shield. Torque is measured by means of a spring scale. The bearing shaft is rotated at 0.25 rpm by means of a one rpm motor. Torque readings are observed at 40-second intervals for a period of 4 minutes, and the average of the six readings is taken as the running torque for the first revolution. Graph No. 15 illustrates torque-temperature curves for the two Na base, one Al base, and three Bentone greases. The Bentone greases contain the same oils and were compounded to have approximately the same consistency as the soap base greases. Data indicate that the low temperature properties of the Bentone greases are equivalent to or possibly superior to the conventional greases, providing oil viscosity and consistency for the two types are equivalent. Field tests are currently under way on a Bentone general purpose automotive type lubricant.

SUMMARY

The properties of the Bentone greases may be briefly summarized as follows:

1. Preparation-Comparatively simple
2. Yield-Good
3. Working Stability-Excellent
4. Consistency-Temperature Characteristics-Excellent
5. Dropping Point-Above the oil flash point
6. Corrosion on Copper Brass-Negligible
7. Oil Separation-Low
8. Wear-Equivalent to Conventional greases
9. Water Resistance
   (a) Washing action-Excellent
   (b) Absorption-High
   (c) Rust Prevention (Inhibited)-Good
10. Metal Adhesion-Excellent
11. Oxidation Resistance (Inhibited)-Excellent
12. High Temperature Performance (Base grease)-Mediocre
13. Low Temperature Properties-Good

Chairman T. G. Roehner, Director of the Technical Service Department, Socony-Vacuum Laboratories

ASTM Technical Committee G, at their Washington meeting, decided that further test work is necessary to improve their method for evaluating wheel bearing greases before it will again be regarded as ready for the first step toward adoption as a standard method, i.e., publication on a "for information only" basis. Actually, considerable progress has been made toward better definition of the details of the method and also in respect to crystallization of ideas regarding interpretation of the test results. It is realized that any method wherein the duration of the test is six hours must be questioned when it is known that its data may be used to predict the behavior of a grease during 10,000 miles or longer time under actual service conditions. Moreover, it is recognized that although the tester is built around a modified Ford wheel hub assembly, the results may be applied not only to passenger cars but also to comparatively heavy duty truck and bus equipment. To a certain extent, the problem has been made more difficult by the fact that the grease industry has steadily improved premium grade greases so that the quality of current commercial products averages much higher than that of the conventional cup or lime soap and tough fibre soda soap greases commonly marketed in the days of the Model T. This point is one of those in the background which promoted discussion of the significance of results presented in previous reports of ASTM Technical Committee G' Section of Function Grease Testers. The greases adopted in both surveys run by that working group were products to which their suppliers gave ratings of poor, fair, or good, based on experience with large quantities marketed over an extended period of time. It was disturbing that the method as formerly defined did not consistently show the corresponding performance under the specified test conditions. Instead, the results indicated that the conditions possibly were nnot sufficiently severe. There is now good reason to suspect that an increase in the amount of grease charged would be the additional change required to bring the method in line. That statement is largely based on information presented to the aforementioned meeting by Mr. C. W. Georgi, of Quaker State Oil Refining Corporation. His extensive tests, covering a wide range of variables, pointed to the size of the sample charged as a critical factor and, when it was held within certain limits, his results led to ratings which were in step with field experiences with those greases, particularly in respect to leakage to the brakes. The next program to be undertaken by the group of about twenty-four cooperators, who did the work on the previous two surveys, will give a prominent spot to investigation of that factor.

It is the consensus to-date that the subject method is primarily a screening test and when completed it will evaluate greases in terms of leakage tendencies. Of course, if the assembly is overpacked, leakage must occur and the objective will be to approach that limit but not exceed it.

Unfortunately, a product which shows good performance even by the proposed modified method may not guarantee freedom from wheel bearing troubles, but it will have a good chance of avoiding the most common complaint, i.e., leakage to the brakes. The method will not cover other possible causes of trouble, such as: 1. The bearings may be adjusted improperly so they operate too loosely or too tightly. 2. The grease may be permitted to become contaminated with dirt or other abrasive materials. 3. The reverse of the overpacking may occur, i.e., use of too little grease so that the bearing eventually runs dry. 4. The greases may undergo marked changes in characteristics after extended service, due to oxidation reactions or changes in soap dispersion.

Considering the importance of wheel bearing lubrication, it will be apparent that the development of the subject method represents a valuable contribution toward safer operation and lower maintenance costs, because the use of the method will lead to the uncovering of products not suitable for this type of requirement. However, it will still be true that periodic repacking of the bearings in accordance with automotive, bearing and grease industry recommendations will continue to be necessary to really maintain a reasonable factor of safety in those respects.

ABOUT THE COVER

Continued from Page 8

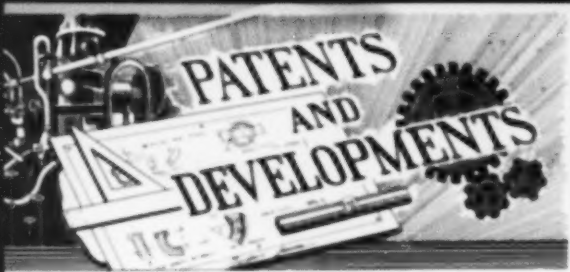
The elapsed time in hours from the beginning of the test to the time at which the desired pressure is reached is reported for each sample. Depending upon the character of the ingredients, greases show stability times up to 400 hours or more.

With the growing demand by the grease industry for fatty acids and fats with special properties, the Hardesty organization is producing a variety of products which cover a wide range of melting points and iodine values.

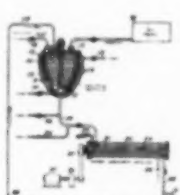
Animal, marine and vegetable fatty acids and special high melting point glycerides are offered to the grease maker.

The highest quality in all of these materials is assured by constant research and development work and by careful chemical control of eac hprocess in manufacture.

The W. C. Hardesty Company, Inc., facilities and personnel are at the service of lubricating grease processors, both for tailoring existing fats and fatty acid products to their specific requirements and fo rthe creation of new products to meet new demands.



CHASSIS GREASE—Several patents issued to Standard Oil Development Co. (Can. 463,449-50) disclose a process for preparing a lubricating grease for chassis and machinery parts which involves thorough mixing, in a pressure kettle, a viscous hydrocarbon oil, an aluminum soap of a saturated fatty acid containing between 10-20 carbon atoms in a molecule, and a lesser amount of compound which inhibits the crystallization in mineral oil of the soap, rapidly cooling the heated mixture to a temperature at which the grease changes from a rubbery mass to a gel by passing through heat exchanger equipment and allowing the mass to settle. The aluminum soap is preferably aluminum stearate, in amounts of 3-8%, while the crystallization inhibitor is preferably an aluminum soap of petroleum naphthenic acid in amounts of .25-1.5%. The cooling is effected by passing the grease through a helical screw scraper type cooling equipment in which the flow of the heated mixture is opposite to the effect of the motion of the screw and countercurrent to the fluid in the cooling packet (see cut).



A semi-fluid grease for crawler-type tractor chassis employs a mineral oil base of 150-200 seconds Saybolt at 210°F and there is added about 0.1% of polyisobutylene thickener besides 0.5% of a pertoleum naphthenic acid acting as a crystallization inhibitor.

CALCIUM SOAP BASE GREASE—A calcium grease recently covered by Standard Oil Development Co. employs an aromatic-free Coastal mineral lubricating oil, a saturated fatty acid soap of an alkaline earth metal, and an oil-soluble linear olefinic polymer having a molecular weight between 6,000 and 15,000. An example of such a grease contains 70.5% lubricating oil, 20.64% calcium soap of hydrogenerated fish oil acids, 7.85% of oil-soluble linear isobutylene polymer of about 12,000 molecular weight, 0.5% zinc naphthenate and 0.5% phenyl alpha naphthylamine (Can. 463,451).

ALKALINE EARTH SULFONATES—A process for preparing sulfonates having the formula $(RCOCH_2\text{-}SO_3)_2M$ where R reppresents an alkaryl radical containing an alkyl group of 10-26 carbon atoms and M represents an alkaline earth metal, is disclosed in a patent issued to Sinclair Refining Co. The step involved consists of reacting a water-soluble alkaline earth metal chloride with a compound of the formula $RCOCH_2\text{-}SO_2\text{-}O\text{-}M'$ where M' represents an alkali metal, by mixing the alkali metal compound with an excess of the chloride in presence of a polar solvent at 110-220°F (U.S. 2,499,997).

JOURNAL BOX BEARING LUBRICANTS—Texas Co. has developed a new machine for testing car journal box bearing lubricants (JC 2/28/50 p.4).

Developments in *bus and truck lubrication* are discussed in the March issue of Lubrication published by the Texas Co.

MULTIPURPOSE GREASES—Litholine is Sinclair Refining Co.'s multipurpose grease having "increased resistance to heat, cold, water and rusting and enabling service station operators to reduce inventories of both equipment and supplies, eliminating the hazard of error and permitting more rapid servicing of autos". It is said to be a combination of a lithium base soap and a highly refined mineral oil (N.Y. World Telegram, 3/15/50 p.56, JC 3/16/50 p.18).

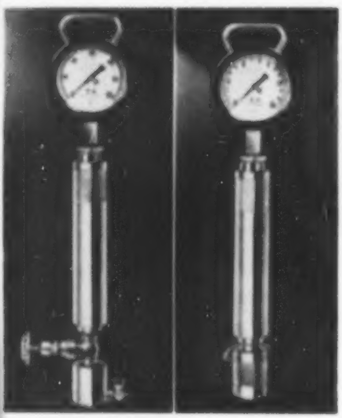
TESTING SPRING SHACKLE GREASES—An Oscillating grease tester designed for bearing grease used in spring shackles, king pins, etc. and developed by Fafnir Bearing Co. and Precision Scientific Co. has been placed on the market. It is said to be useful for testing lubricants to be used for anti-friction bearings undergoing small angle vibratory movements. In operation, the test grease is applied to a simple lever which exerts thrust through a calibrated spring. An electric motor is started to oscillate the test bearings through an angle of 12° at a rate of 3450 reversals/minute under a thrust load of 550 lbs. The test is run continuously for 50 hours before the bearings are weighed and washed again. The test is comparative and the loss of weight in milligrams indicates the suitability of the lubricant (Petroleum Processing 3/50 p.299).

ISSUED PATENTS—636,631 (Standard Oil Development Co.)—Lubricating greases.

PRECISION REID VAPOR PRESSURE BOMBS

Precision Scientific Company has developed light weight Reid Vapor Pressure Bombs suitable for testing aviation gasolines according to the revised A.S.T.M. Method D-353-49. These Reid Bombs are also suitable for ordinary gasoline, benzol blends and volatile liquids. The volume ration of the air chamber to the gas chamber has been held within the close limits set for testing aviation gasolines.

Precision Reid Vapor Pressure Bombs manufactured under the old A.S.T.M. D-325-43 are not interchangeable with the new Bombs. For better, easier sealing, the threads on the gauge and bomb openings were changed from the previous model.



Of particular advantage is the surprisingly light weight of the new bombs. Without the pressure gauge the immersion sampling bombs weigh only three pounds; the pressure sampling bombs weigh 4½ lbs. Composed entirely of nickel-plated brass, the bombs are made with the utmost care and well within the close tolerances specified in the A.S.T.M. procedure. Ease of manipulation and simplicity are prime advantages. The gauge is sealed in place by turning a special coupling furnished; thus, strain on the gauge is released, accuracy is promoted and the danger of stripping gauge and bomb threads is avoided.

Precision Bourden-type Reid Gauges are guaranteed accurate to within 0.5% of the scale range, have stainless steel mechanism.

Both types of bombs were designed to keep space requirements to a minimum. The immersion sampling bomb is 15" high by 2" in diameter; the pressure sampling bomb is 16½" high by 8" through the valves by 2" diameter.

Precision Scientific Co.
3737 W. Cortland Ave.
Chicago 47, Illi.

ALEMITE PRESENTS TWO NEW MODELS

Two models of a portable "one man-one hand operated greasing outfit," for farm, industrial or automotive use, have been announced by the Alemite division of Stewart-Warner Corporation.

Two elements comprise this new greasing outfit,—a loading pump and a grease gun. The loading pump is mounted in a rigid steel cover which fits the top of any standard 25 or 35 pound size original lubricant bucket or pail, replacing the original container cover.

Three hook bolts hold the pump in a positive dirt-tight seal on the container. With a few strokes of the pump handle the gun is filled with lubricant through a leader valve on the pump and a loader fitting on the gun. The gun is then uncoupled and is ready for use.

When the gun is loaded an automatic pressure release discharges the lubricant in the leading pump cylinder back into the grease container, permitting the pump handle to return to "down" position for easy carrying.

Pressure of grease delivery at the fitting is controlled by the operator to fit the requirements of the bearing being serviced. It is possible with either gun, by exerting extreme "push-action," to effect up to 10,000 pounds per square inch delivery pressure on "frozen" bearings. In the case of the "Dyn-O-Mite" gun, this is accomplished by repeated pushing of the grip. With the other gun, described as a pistol type, grease delivery pressure is increased by telescopic movement of the coupling extension back into the gun cylinder.

SUPPLIERS OF MATERIALS FOR MANFACTURING LUBRICATING GREASES

MANUFACTURERS OF EQUIPMENT FOR APPLICATION OF LUBRICATING GREASES

N. L. G. I. GUIDE POST

(Continued)

SUPPLIERS OF EQUIPMENT FOR MANUFACTURING LUBRICATING GREASES

CONTAINER MANUFACTURERS

NOPCO CHEMICAL COMPANY FORMS PACIFIC DIVISION

Nopco Chemical Company, makers of a broad line of industrial chemicals and bulk vitamin and pharmaceutical products, has just announced formation of its new Pacific Division. Announcement was made by Nopco president Thomas A. Printon from the company's home office at Harrison, New Jersey.

The functions of this new division will include sales and all other company activities for the eleven westernmost states of California, Washington, Oregon, Idaho, Montana, Arizona, Nevada, Utah, Colorado, Wyoming and New Mexico as well as the province of British Columbia. In making the announcement, Mr. Printon pointed out that increased sales in this area, plus the rapid industrial expansion taking place in the west, make it important for the company to establish a permanent base for its operations on the Pacific Coast at this time. Special emphasis will be placed on the company's industrial chemical sales.

The Pacific Division will be headed by Perc S. Brown, a company vice-president, assisted by Harold A. Swanson as general sales manager. Arthur V. Swarthout, formerly of the Fiscal Department, will handle the extensive market survey work required. Organization details and arrangements are now being worked out at the company's Harrison office. Until they are complete the company plans no change in its present western sales set up.

Mr. Brown, in preparation for this move, has spent a great deal of time during the last year at Richmond, California, where Nopco already has a plant devoted to vitamin oil processing. In addition to his new duties, he will retain his active role as an officer of the company and member of the Executive Committee and Board of Directors.

Mr. Swanson has been with Nopco thirteen years, eight as patent attorney and five as general counsel. In this work he has gained a wide and intimate knowledge of Nopco products, particularly those produced under company held patents or license agreements. He holds a degree in chemical engineering from Northeastern University in addition to his law degree from George Washington University.

Mr. Swarthout plans to leave for the west coast about June 1, to start his survey work. Mr. Brown and Mr. Swanson, however, will not take up residence there until later in the year, probably sometime duirng the last quarter. Mr. Swarthout will be succeeded in the Fiscal Department at the home office by Robert M. Urich, and Mr. Swanson in the Legal Department by J. James Denzler.

FUTURE MEETINGS OF YOUR INDUSTRY

MAY

1-4 AMERICAN PETROLEUM INSTITUTE (Division of Refining, mid-year meeting)
Hotel Cleveland, Cleveland, Ohio

1-4 Chamber of Commerce (annual meeting)
Washington, D. C.

7-9 Independent Petroleum Assn. of America (21st mid-year meeting)
Biltmore Hotel, Los Angeles, Calif.

11-12 AMERICAN PETROLEUM INSTITUTE (Division of Production, Pacific Coast district)
Biltmore Hotel, Los Angeles, Calif.

14-16 Empire State Petroleum Assn.
Hotel Roosevelt, New York, N.Y.

15-17 OIL INDUSTRY INFORMATION COMMITTEE
Palmer House, Chicago, Ill.

15-18 AMERICAN PETROLEUM INSTITUTE (mid-year meeting on safety, central committees on accident prevention and fire protection)
Chalfonte-Haddon Hall, Atlantic City, N. J.

15-18 National Fire Protection Assn.
Chalfonte-Haddon Hall, Atlantic City, N. J.

JUNE

1-2 American Management Assn. (general management)
Waldorf-Astoria Hotel, New York, N. Y.

4-7 American Gear Manufacturers Assn.
The Homestead, Hot Springs, Va.

4-9 Socy. of Automotive Engineers (summer meeting)
French Lick Springs Hotel, French Lick, Ind.

12-16 American Socy. of Mechanical Engineers (oil and gas power division)
Lord Baltimore Hotel, Baltimore, Md.

12-16 American Socy. of Mechanical Engineers (4th national materials handling and exhibit)
International Amphitheater, Chicago, Ill.

18-20 Petroleum Equipment Suppliers Assn.
The Greenbrier, White Sulphur Springs, W. Va.

19-23 American Socy. of Mechanical Engineers
Hotel Statler, St. Louis, Mo.

22-24 American Socy. of Mechanical Engineers (applied mechanics)
Purdue University, Lafayette, Ind.

26-30 American PETROLEUM INSTITUTE (Division of Production, mid-year standardization committee conference)
Brown Palace Hotel, Denver Colo.

26-30 American Socy. for Testing Materials (annual meeting)
Chalfonte-Haddon Hall
Atlantic City, N. J.

AUGUST

14-16 Socy. of Automotive Engineers (west coast meeting)
Biltmore Hotel,
Los Angeles, Calif.

SEPTEMBER

3-8 American Chemical Society
Chicago, Ill.

"LITHIUM IN MODERN INDUSTRY" PUBLISHED BY FOOTE MINERAL

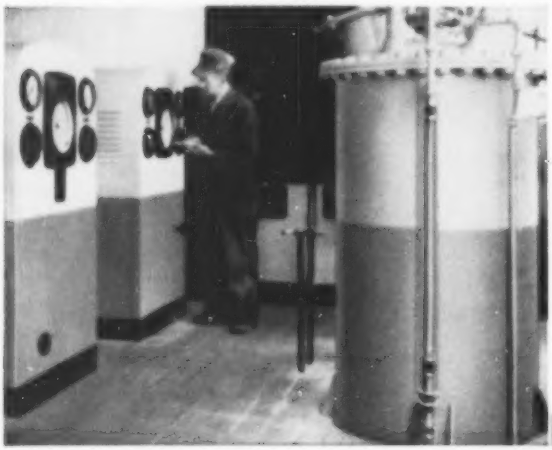
A newly published 28 page booklet, "Lithium in Modern Industry", reviews and forecasts significant developments in lithium chemistry since 1940. Edited by the technical sales, research and development staffs of Foote Mineral Company, this volume discusses the chemistry of lithium, and lithium salts, the industrial applications of lithium compounds, and newer uses of these materials. Also included is a carefully edited bibliography of technical references and numerous tables and other data.

A copy will be sent upon request to Foote Mineral Company, 18 W. Chelten Ave., Philadelphia 44, Pa.

Votator

GREASE MAKING APPARATUS

CUTS USE OF INGREDIENTS



★ With VOTATOR Grease Making Apparatus, less stearate is required to make aluminum and lithium stearate lubricating grease. This savings is effected because the more thorough mixing gives greater dispersion of stearate throughout the oil.

VOTATOR Grease Making Apparatus also makes possible accurate measurement of ingredients . . . assures a uniform product at all times, and avoids reworking with resultant loss of man-hours. And, this totally enclosed system is clean.

VOTATOR Grease Making Apparatus cooks and cools the ingredients in a three-minute time cycle. Automatic control of the entire process enables one man to do the job. Write for more complete information. The Girdler Corporation, Louisville 1, Ky.

DISTRICT OFFICES: 150 Broadway, New York City 7
2612 Russ Bldg., San Francisco 4
22 Marietta Bldg., Rm. 1600, Atlanta, Ga.

VOTATOR is a trade mark applying only to products of The Girdler Corporation

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Scientifically

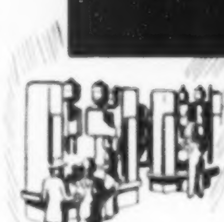
CONTROLLED MANUFACTURING

Every product that is manufactured by the Cato Oil & Grease Company is the final result of exhaustive laboratory tests. Actual manufacturing of all Cato lubricants is scientifically controlled. For that reason, many desirable "extras" are added to even the most highly refined lubricants. Look to Cato for quality lubricants that can be counted on for above-the-average performance.

Top Quality

CATO

LUBRICANTS

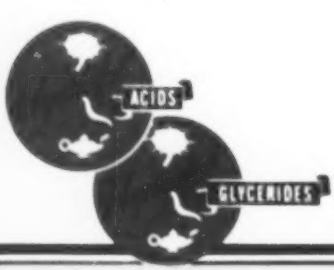


Engineered

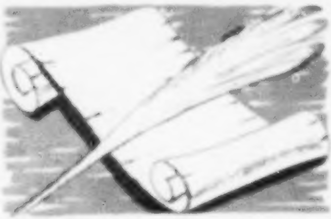
APPLICATION SERVICE . . .

Cato's engineered application service assures proper application of all lubricants manufactured by the company. Cato engineers are waiting to serve you whenever difficulties arise anxious to assist you in working out difficult lubrication problems.

CATO OIL AND GREASE CO., OKLAHOMA CITY, OKLA., U.S.A. MANUFACTURERS DISTRIBUTORS & EXPORTERS OF LUBRICANTS


ACIDS
GLYCERIDES

Associate and Technical Members . . . of the National Lubricating Grease Institute



Supporting Your Organization These Suppliers of Your Industry Hold Membership in the N. L. G. I.

SUPPLIERS OF MATERIALS FOR MANUFACTURING LUBRICATING GREASES

Armour & Co., Chemical Division
1355 West 31st St.
Chicago 9, Illinois
Member—Dale V. Stingley

American Cyanamid Company
30 Rockefeller Plaza
New York City, New York
Member—A. Scharwachter

Darling & Company
4201 South Ashland Avenue
Chicago 9, Illinois
Member—George W. Trainor

Emery Industries, Inc.
Carew Tower
Cincinnati 2, Ohio
Member—R. F. Brown

Foote Mineral Company
18 W. Chelton Street
Philadelphia 44, Pennsylvania
Member—H. C. Meyer, Jr.

A. Gross & Company
295 Madison Avenue
New York City 17, New York
Member—Eugene Adams

W. C. Hardesty Co., Inc.
41 East 42nd Street
New York City, New York
Member W. G. McLeod

Harshaw Chemical Company
1945 East 97th Street
Cleveland 6, Ohio
Member—G. G. Urkefer

Lubrizol Corporation
Euclid Station
Cleveland 17, Ohio
Member—J. H. Baird

Mallinckrodt Chemical Works
New York 8, New York
St. Louis 7, Missouri
Member—C. E. Cosby

N. I. Malmstrom & Company
147 Lombardy Street
Brooklyn 22, New York
Member—Ivar Wm. Malmstrom

Metasap Chemical Corporation
Harrison, New Jersey
Member—O. E. Lohrke

Monsanto Chemical Company
1700 Second Street
St. Louis 4, Missouri
Member—J. W. Newcombe

National Lead Company
105 York Street
Brooklyn 1, New York
Member—Alexander Stewart

National Rosin Oil Products, Inc.
R.K.O. Bldg., Rockefeller Center
New York City, New York
Member—Richard Bender

M. W. Parsons, Imports & Plymouth Organic Labs., Inc.
59 Beekman Street
New York City 7, New York
Member—H. Bye

Swift & Company, Industrial Oil Division
165th & Indianapolis Blvd.
Hammond, Ind.
Member—F. H. Beneker

Warwick Chemical Company
Division of the Sun Chemical Corporation
10-10 44th Avenue
Long Island City 1, New York
Member—Dr. J. J. Whitfield

The Werner G. Smith Co.
(Division of Archer-Daniels-Midland Co.)
2191 West 110th Street
Cleveland 2, Ohio
Member—F. C. Haas

Witco Chemical Co.
75 E. Wacker Drive
Chicago, Illinois
Member—B. W. Lewis

CONTAINER MANUFACTURERS

Central Can Company, Inc.
2415 West 19th Street
Chicago, Illinois
Member—Henry Frazin

Continental Can Co.
1103 Waldheim Building
Kansas City 6, Missouri
Member—N. M. Potts

Geuder, Paeschke & Frey Co.
324 North Fifteenth Street
Milwaukee 3, Wisconsin
Member—Willard J. Flint

Inland Steel Container Company
6532 South Menard Avenue
Chicago 38, Illinois
Member—J. T. Gossett

J & L Steel Barrel Company
70 East 45th Street
New York City, New York
Member—Jerry Lyons

National Steel Container Corporation
6700 South LeClaire Avenue
Chicago 38, Illinois

Rheem Manufacturing Company
570 Lexington Avenue
New York, New York
Member—G. Wesley Gates

United States Steel Products Co.
30 Rockefeller Plaza
New York City 20, New York
Member—Wm. I. Hanrahan

Vulcan Stamping & Manufacturing Co.
300 Madison Street
Bellwood, Illinois
Member—Dale M. Harpold

MANUFACTURERS OF EQUIPMENT FOR APPLICATION OF LUBRICATING GREASES

The Aro Equipment Corporation
Bryan, Ohio
Member—R. W. Morrison

Balcrank, Inc.
Disney near Marburg
Cincinnati 9, Ohio
Member—R. P. Field

Gray Company, Inc.
60 11th Avenue Northeast
Minneapolis 13, Minnesota
Member—L. L. Gray

Lincoln Engineering Company
5730 Natural Bridge Avenue
St. Louis, Missouri
Member—Foster Holmes

National Sales, Inc.
812 North Main Street
Wichita, Kansas

Stewart-Warner Corp.
1826-1852 Diversey Parkway
Chicago, Illinois
Member—Walter Duncan

U. S. Air Compressor Company
5300 Harvard
Cleveland, Ohio
Member—C. A. Bening

LABORATORY EQUIPMENT AND SUPPLIES

Precision Scientific Company
3737 Cortland Street
Chicago 47, Illinois
Member—Alexander I. Newman

SUPPLIERS OF EQUIPMENT FOR MANUFACTURING LUBRICATING GREASES

Buflovak Equipment Division of Blaw-Knox Company
1543 Fillmore Avenue
Buffalo 15, New York
Member—A. W. Johnson

The Girdler Corp.
Louisville 1, Kentucky
Member—John E. Slaughter, Jr.

Stratford Engineering Corporation
1414 Dierks Building
Kansas City, Missouri
Member—J. A. Altshuler

REFINERS

Calumet Refining Company
4323 Southwestern Blvd.
Chicago, Illinois
Member—H. T. Somerau

Farmers Union Central Exchange, Inc.
P. O. Box G
St. Paul 1, Minnesota
Member—H. F. Wagner

Mid-Continent Petroleum Corporation
Tulsa, Oklahoma
Member—T. E. Fitzgerald

TECHNICAL AND RESEARCH ORGANIZATIONS

Cargill, Incorporated
200 Grain Exchange
Minneapolis 15, Minnesota
Member—Dr. Sabine Hirsch

Mellon Institute of Industrial Research
University of Pittsburgh
Pittsburgh 13, Pennsylvania
Member—Malcolm Finlayson

Midwest Research Institute
4049 Pennsylvania
Kansas City 2, Missouri